

Appl. No. 09/870,537
Amdt. dated April 7, 2005
Reply to Office Action of November 29, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (currently amended). A method of generating a halftone image from an input digital image, said digital image represented by a multiplicity of pixels, each pixel having a given value, said values being stored in a memory, said method comprising the steps of:

(A) determining the properties including local properties of the digital image;

~~(A)~~ (B) filtering the input digital image, said filtering having as output a filtered value at each pixel;

~~(B)~~ (C) obtaining the difference between the value at the pixel and the filtered value at the pixel, said difference being a threshold input;

~~(C)~~ (D) generating the output state for the pixel depending upon the relationship of the value of said threshold input relative to a threshold;

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~~(D)~~(E) producing an error value, said error value being indicative of the deviation of said threshold input from the output state;

~~(E)~~(F) multiplying said error value by a coefficient, the result of said multiplication being stored;

~~(F)~~(G) combining the stored value with the difference between the next pixel value and the next filtered value to produce a new threshold input;

~~(G)~~(H) repeating steps ~~(E)~~(D) through ~~(F)~~(G) for each pixel in the digital image thereby producing a halftone image; and

varying the threshold according to properties of the digital image; and

selectively changing the coefficient in step ~~(E)~~(F) according to the local properties of the digital image.

Claim 2 (currently amended). The method of Claim 1 further comprising the step of:

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performing a histogram modification of the image pixels, before step (AB).

Claim 3 (currently amended). The method of Claim 1 further comprising the step of:

performing a histogram modification of the difference between the value at the pixel and the filtered value at the pixel, before step (ED).

Claim 4 (original). The method of Claim 1 wherein the selectively changing of the coefficient comprises:

dividing a first function of the local values of the digital image by a second function of the local values of the digital image; and

multiplying the absolute value of the result of said division by a first parameter; and

adding a second parameter to the result of the multiplication, thereby obtaining the coefficient.

Claim 5 (original). The method of Claim 4 wherein said first function is the difference between the value at the pixel and the filtered value at the pixel and said second function is the filtered value at the pixel.

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Claim 6 (currently amended). The method of Claim ~~4~~
4 wherein the threshold is a third function of the local
values of the digital image.

Claim 7 (original). The method of Claim 6 wherein
said third function is a linear function of the local
values of the digital image.

Claim 8 (canceled hereby).

Claim 9 (currently amended). The method of Claim ~~8~~
6 wherein said third function is a linear function of
the local values of the digital image.

Claim 10 (original). The method of Claim 4
wherein the threshold is the filtered value at the pixel
multiplied by a third parameter.

Claim 11 (currently amended). The method of Claim
10 wherein the filter in step (~~A~~B) is a filter of
finite extent, the extent of the filter, the first,
second parameters and third parameters being selected to
produce the image of highest perceptual quality at a
specific output device.

Claim 12 (currently amended). The method of Claim
10 further comprising the step of:

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performing a histogram modification of the difference between the value at the pixel and the filtered value at the pixel, before step(€D).

Claim 13 (original). The method of Claim 1 wherein the input digital image is a monochrome image.

Claim 14 (original). The method of Claim 1 wherein the input digital image is a color image.

Claim 15 (currently amended). A system for generating a halftone image from an input digital image, said digital image represented by a multiplicity of pixels, each pixel having a given value, said values being stored in a memory, said apparatus comprising:

means for determining the properties including local properties of said digital image; and

means for retrieving the pixel values; and

means for filtering the input digital image, said filtering having as output a filtered value at each pixel; and

means for obtaining the difference between the value at the pixel and the filtered value at the pixel, said difference being a threshold input; and

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means for producing an error value, said error value being indicative of the deviation of said threshold input from the output state; and

means for multiplying said error value by an adaptation coefficient to obtain a diffused value and

means for storing the diffused value and delaying said stored value by one pixel; and

means for combining the stored delayed diffused value with the difference between the pixel value and the filtered value; and

means for varying the threshold according to the properties of the digital image at the pixel value; and

means for selectively changing the adaptation coefficient according to the local properties of the digital image.

Claim 16 (original). The system of Claim 15
further comprising:

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means performing a histogram modification of the image pixels.

Claim 17 (original). The system of Claim 15 further comprising:

means for performing a histogram modification of the difference between the value at the pixel and the filtered value at the pixel.

Claim 18 (original). The system of Claim 15 wherein the means for selectively changing of the adaptation coefficient comprise:

means for dividing a first function of the local values of the digital image by a second function of the local values of the digital image; and

means for multiplying the absolute value of the result of said division by a first parameter; and

adding a second parameter to the result of the multiplication, thereby obtaining the coefficient.

Claim 19 (currently amended). A computer program product comprising:

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a computer usable medium having computer readable code embodied therein for generating a halftone image from an input digital image, said digital image represented by a multiplicity of pixels, each pixel having a given value, said values being stored in a memory, said code causing a computer system to:

determine the properties including local properties of said digital image; and

retrieve the pixel values; and

filter the digital image, said filtering having as output a filtered value at each pixel; and

obtain the difference between the value at the pixel and the filtered value at the pixel, said difference being a threshold input; and

produce an error value, said error value being indicative of the deviation of said threshold input from the output state; and

multiply said error value by an adaptation coefficient to obtain a diffused value; and

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store the diffused value and delaying said stored value by one pixel; and

combine the stored delayed diffused value with the difference between the pixel value and the filtered value; and

vary the threshold according to the properties of the digital image at the pixel value; and

selectively change the adaptation coefficient according to the local properties of the digital image.

Claim 20 (original). The computer program product of Claim 19 where, the computer readable code further causes the computer system to:

perform a histogram modification of the image pixels.

Claim 21 (original). The computer program product of Claim 19 where, the computer readable code further causes the computer system to:

perform a histogram modification of the difference between the value at the pixel and the filtered value at the pixel.

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Claim 22 (original). The computer program product of Claim 19 where, the computer readable code in causing the computer system to selectively change the adaptation coefficient, further causes the computer system to:

divide a first function of the local values of the digital image by a second function of the local values of the digital image; and

multiply the absolute value of the result of said division by a first parameter; and

add a second parameter to the result of the multiplication, thereby obtaining the coefficient.

Claim 23 (original). The computer program product of Claim 22 wherein said first function is the difference between the value at the pixel and the filtered value at the pixel and said second function is the filtered value at the pixel.

Claim 24 (currently amended). The computer program product of Claim ~~19~~ 22 wherein the threshold is a third function of the local values of the digital image.

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Claim 25 (original). The computer program product of Claim 24 wherein said third function is a linear function of the local values of the digital image.

Claim 26 (canceled hereby).

Claim 27 (currently amended). The computer program product of Claim ~~26~~ 24 wherein said third function is a linear function of the local values of the digital image.

Claim 28 (original). The computer program product of Claim 23 wherein said the threshold is the filtered value at the pixel multiplied by a third parameter.

Claim 29 (original). The computer program product of Claim 28 wherein the filter used to filter the digital image is a filter of finite extent, the extent of the filter, the first, second parameters and third parameters being selected to produce the image of highest quality at a specific output device.

Claim 30 (original). The computer program product of Claim 28 where, the computer readable code further causes the computer system to:

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perform a histogram modification of the difference between the value at the pixel and the filtered value at the pixel.

Claim 31 (original). The computer program product of Claim 19 wherein the input digital image is a color image.

Claim 32 (original). The computer program product of Claim 19 wherein the input digital image is a monochrome image.